

**REMARKS**

Claims 1-14 are pending and subject to the following rejections.

- Claims 1-14 stand rejected under 35 U.S.C. §102(b) for anticipation by, or in the alternative, under 35 U.S.C. §103(a) for obviousness over JP 11-021,197.
- Claims 1, 3, 5 and 10 are rejected under 35 U.S.C. §103(a) for obviousness over U.S. Publication No. 2004/0099205 to Li et al. in view of Applicants' disclosure on pages 2-3 of the present application and JP 2000-272,990.
- Claims 1, 4, 5 and 11 are rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 6,332,922 to Sakuma et al. or U.S. Patent No. 6,673,150 to Garibin et al., either in view of Applicants' disclosure on pages 2 and 3 of the present specification and JP '990.
- Claims 1-14 stand rejected under 35 U.S.C. §103(a) for obviousness over the Li publication in view of Applicants' disclosure at pages 2-3 of the present specification, JP '990 and JP '197.

Applicants respectfully traverse these rejections for the following reasons.

**Rejection of claims 1-14 over JP '197**

Claim 1 is directed to an as-grown single crystal of an alkaline earth metal fluoride that is produced by a single crystal pulling method and which is not annealed. The resulting crystal has a straight barrel part diameter of not less than 17 cm and light transmittance at a wavelength of 632.8 nm of not less than 80%. These structural features of a crystal produced in a single-crystal pulling method are not taught or suggested by JP '197.

The Declaration of Mr. Nawata submitted September 29, 2005 (first Nawata Declaration) clearly demonstrates that single-crystal pulling does not necessarily yield a single crystal having the claimed properties (dimensions and transmittance). The data presented therein proves that use of the CZ method does not inherently result in a crystal as claimed.

The Examiner has previously asserted that the crystal produced via JP '197 when annealed would meet the claims. This is incorrect. Annealing has no impact on opacity (light transmittance). Instead, the roughness of the crystal surface determines opacity. It should be readily appreciated that a heat treatment (annealing) would not alter the surface quality of a crystal. Annealing does not alter the basic physical structure of the

crystal, such as its shape and surface quality (roughness). Thus, even if the crystals produced via JP '197 or as produced in the first Nawata Declaration were annealed, their surface quality would not change. They could not achieve the claimed light transmittance by annealing.

Accordingly, Applicants have already demonstrated that the claimed crystals are distinct and non-obvious over the crystals produced via JP '197. Withdrawal of the rejection based thereon is respectfully requested.

**Rejections based on the Li publication, the Sakuma patent and/or the Garibin patent**

The Li publication and Garibin patent both relate to the production of calcium fluoride single crystals by a crucible depression method, the BS method. The Sakuma patent discloses annealing of a  $\text{CaF}_2$  crystal produced by the BS method.

The JP '990 reference discloses a crucible having an inner surface onto which a lining of carbon is deposited by a pyrolysis method to coat and smooth the inner surface. This smooth lining on the inner surface is designed to prevent cracking of the crucible and contamination of crystals grown according to the BS method.

The description at page 2, line 15 to page 3, line 15 in the present specification is consistent with these teachings. In the BS method, it is well known that the peripheral surface of the resulting single crystal becomes opaque. When a single crystal is produced via the BS method, the inner wall of the crucible contacts the liquid surface of the starting material melt. This continuous contact with the crucible wall creates opacity in the crystal. As such, the as-grown crystal cannot achieve the high visible light transmittance required by claim 1 when produced according to the BS method, **whether or not annealed**.

In order to demonstrate that an as-grown crystal having the claimed light transmittance cannot be obtained by the BS method, Applicants conducted the tests reported in the accompanying Declaration. The Declaration compares the results of producing a crystal according to the present invention (Experiment A) with a crystal produced according to the BS method (Comparative Experiment B) and a crystal produced according to the BS method using a crucible having a lining deposited by the method of JP '990 (Comparative Experiment C). The results of these experiments are summarized below.

SUMMARY OF DATA FROM DECLARATION UNDER 37 CFR 1.132

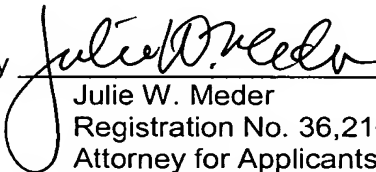
Properties	Experiment A (invention)	Comparative Experiment B (BS method)	Comparative Experiment C (BS method with lined crucible)
Straight barrel diameter (cm)	28	6	6
Height (cm)	10	15	15
Surface Roughness ( $\mu\text{m}$ )	0.44	Too rough to measure	3.4
Transmittance at 632.8 nm (%)	91.5	5.2	48.8

It is evident that crystal produced according to the present invention has significantly higher transmittance at 632.8 nm (92%) than a crystal produced according to the BS method (5%) or a BS method with the crucible having been lined according to JP '990 (49%). To the extent that the lining of a crucible with pyrolitic carbon according to JP '990 smoothes the surface of the crucible and thus smoothes the surface of the crystal produced according to the BS method, this is still insufficient to achieve the crystal of the present invention. At about 49% transmittance, the transmittance was still far lower than claimed. The surface roughness of the crystal produced according to the BS method in combination with JP '990 still results in a surface roughness that is unacceptably high (3.4  $\mu\text{m}$ ), which caused low transmittance at 632.8 nm as reported above. Accordingly, even if the teachings of JP '990 were used in combination with any of the Li, Sakuma or Garibin references, a crystal having a light transmittance of at least 80% at 632.8 nm could not be achieved. Therefore, claims 1-14 define over the prior art of record.

Reconsideration of the rejections and allowance of claims 1-14 is respectfully requested.

Respectfully submitted,

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